IN-SITU X-RAY CHARACTERIZATION OF PHASE EVOLUTION DURING SOLID-STATE REACTIONS OF MULTICOMPONENT SYSTEMS

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The discovery of new solid inorganic materials cuts across their synthesis, nanostructure and properties. They cover both structural and functional materials and have potential impact in a wide range of technologies. Understanding the synthesis pathways of these solid-state materials is a prerequisite in correlating chemistry and nanostructure to properties.

Advanced processing and synthesis methods such as High Temperature Flux, Electrical Flash Sintering and Microwave Synthesis, require probing the time resolved state of materials, in order to understand the kinetics and structure of intermediate phases. This need is addressed by fast in-situ atomic level x-ray characterization techniques such as X-ray Diffraction (XRD) and X-ray Pair Distribution Function (PDF), which have been implemented at the 3rd generation synchrotron sources around the world.

In this presentation I will be discussing how XRD and PDF tools are used to study the synthesis mechanisms and evolution of crystal compositional phases for the ceramic and battery materials. Providing a few examples, I will describe the technical aspects of the tools, the capabilities for sample environments and results from the XPD beamline at the NSLS-II synchrotron radiation source of Brookhaven National Laboratory. This presentation will not only provide information on the topics discussed but also open up new ideas to look at new materials with different prospective.